

## **REMARKS**

### **Status of the Claims**

Claims 1-25 are pending in this application. The Examiner has rejected claims 1-25 under each of 35 U.S.C. §§ 112 (first and second paragraphs) and 102(b) or 103(a) in view of several patent references. Applicants have not amended the claims in this paper. Accordingly, no new matter has been added.

### **Rejection of claims 1-25 under 35 U.S.C. § 112**

The Examiner has rejected claims 1-25 under 35 U.S.C. § 112, first paragraph, for failing to comply with the written description requirement. Office Action at 2. The Examiner contends that "[t]he claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention" because "[t]he specification as filed does not disclose that the vinyl aromatic polymer blocks have a block rate of 10-90%. *Id.* Applicants respectfully disagree with the Examiner's rejection because the originally filed claims expressly recite this aspect:

"wherein the vinyl aromatic hydrocarbon constituting the block copolymer has a block rate of from 10 to 90% by weight..."

U.S. Patent Application 10/512,410, Specification as filed October 25, 2004, p. 82. In addition to the original claims, the specification describes the block rate aspect at pages 7-9 of the original disclosure (*Id.* at pp. 7-9) and also provides examples of polymers which exemplify vinyl aromatic hydrocarbons with a block rate of from 10 to 90% by weight (*Id.* at Table 1, p. 72). The term "block rate" is described mathematically on page 9 of the specification. *Id.* at 9. Applicants also provide guidance and references

to the scientific literature for how one may calculate the block rate of the vinyl aromatic hydrocarbon incorporated into the block copolymer of the invention. *Id.* In light of the clear description the "block rate" aspect of their claims in the originally filed specification (including the claims), Applicants respectfully submit that they were in possession of the claimed invention when they filed the application and request that the Examiner withdraw the rejection of claims 1-25 under 35 U.S.C. § 112, first paragraph.

The Examiner has rejected claims 1-25 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. *Id.* The Examiner points to example 1 in the specification, which discloses processes for producing mixtures of block copolymers and, in the Examiner's opinion, may produce a mixture of block copolymer with styrene-butadiene in an "apparently random copolymer." *Id.* Applicants believe that the Examiner is referring to the non-limiting examples described at pp. 51-53, specifically "1) Block Copolymer A-1...." *Id.* at 52-3. The Examiner asserts that this example makes it unclear what Applicants mean in line 1 of claim 1 by "(a) block copolymer" because he believes that "some examples such as example 1 actually produces a mixture of block copolymer with styrene-butadiene apparently random copolymer..." Office Action at 2. Applicants respectfully submit that their data supports their assertion that the block copolymer described in Example 1 does fall within the scope of claim 1.

The block copolymer of Applicants' Example 1 consists of plural block copolymers showing a bimodal structure. This composition is confirmed by molecular weight distribution data acquired by GPC. See Specification at Table 1, p. 72. As

described in the Specification, this block copolymer was obtained by deactivating part of block copolymer components in the course of polymerization by the addition of methanol, to thereby generate two block copolymers having a different molecular weight and structure from each other. *Id.* at pp. 52-53. Thus, from the standpoint that the "block copolymer" as recited in claim 1 embraces a product composed of plural species of block copolymers, it might be interpreted as a "mixture" as contended by the Examiner. However, even if the product is composed of plural block copolymers, the fact that each respective copolymer component has a block copolymer structure remains unchanged. Applicants respectfully submit that one of ordinary skill in the art would recognize that the term "block copolymer" does not require that each unitary molecule of the "block copolymer" shares an identical structure, provided that, where plural block copolymers exist in the mixture, each component is a block copolymer. Where the product of a polymerization comprises at least one block (i.e., homopolymeric sections in the polymer that have a degree of polymerization of 30 or more) as part of a polymer, the product is a block copolymer. This interpretation is consistent with Applicants examples, including Example 1. Applicants also refer the Examiner to their analysis of the art cited by the Examiner in his 102(b)/103(a) rejections because Applicants have discussed each of these references in terms of the blocks and block copolymer elements of their claims.

Applicants respectfully submit that the Examiner has not provided any objective reasons for why the data provided in the Application should be ignored. Absent evidence to the contrary, Applicants' data should be given full faith and credit.

Applicants respectfully request that the Examiner withdraw the rejection of claims 1-25 under 35 U.S.C. § 112, second paragraph.

**Rejection of claims 1-25 under 35 U.S.C. § 102(b) for anticipation and/or under 35 U.S.C. § 103 for obviousness**

**Rejection of claims 1-25 in view of U.S. Patent No. 5,227,419.**

The Examiner has rejected claims 1-25 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a), as obvious over U.S. Patent No. 5,227,419 ("the '419 patent"). Office Action at 2-4. The Examiner points to the '419 patent at column 9, lines 6 *et seq*, which he believes discloses a process in which styrene/diene block copolymers having greater than 60% styrene are produced by using alkyl lithium initiators and having blocks produced from pure charges of styrene and other blocks produced from mixed charges of styrene/diene containing predominately styrene in the presence of randomizer. *Id.* at 3. The Examiner contends that "[s]ince Applicants' specification produces block copolymers having these features it would reasonably appear that applicants and patentees materials inherently have identical characteristics." *Id.* at 3.

The Examiner supports the rejection, paraphrasing *In re Fitzgerald*: "When the reference discloses all the limitations of a claim except a property or function, and the Examiner cannot determine whether or not the reference inherently possesses properties which anticipate or render obvious the claimed invention, basis exists for shifting the burden of proof to applicant." Office Action at 4; See *In re Fitzgerald et al.* 619 F. 2d 67,70,205 USPQ 594,596, (CCPA 1980); see also MPEP § 2112. Applicants

respectfully submit that *Fitzgerald* does not apply to this case because the '419 patent, when read in light of well-recognized principles of polymerization science, neither anticipates nor renders obvious Applicants' claims. Rather, the '419 patent describes procedures which lead to polymers outside of the scope of Applicants' claims.

In rejecting Applicants' claims over the '419 patent, the Examiner refers to column 9, lines 6 *et seq.* As described below, the '419 patent teaches a procedure which creates a polymer with only 6.5% of it's vinyl aromatic hydrocarbon blocks having a molecular weight of 35,000 or less. As 6.5% is far outside the range of 40-80% in the pending claims and the Examiner has provided no reason to modify 6.5% to over 6 times that value, Applicants respectfully submit that the '419 patent neither anticipates nor renders obvious their claims 1-25.

Example 2 of the '419 patent describes synthesizing a polymer in five steps. The amount of styrene added in each of these steps is as follows:

Step 1: 30 phm;

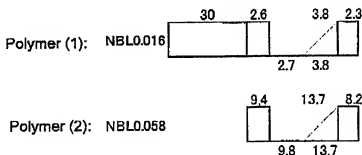
Step 2: 12 phm;

Step 4: 17.5 phm;

Step 5: 10.5 phm.

In order to initiate polymerization, n-butyllithium (NBL) is added during step 1 (0.016 phm) and step 2 (0.058 phm). As a result, the number of anionic equivalents differs from step 1 and the steps that follow because step 1 polymerizes in the presence of 0.016 phm of anion and steps 2-5, which follow the additional 0.058 phm of NBL, are subjected to a total of 0.074 equivalents (i.e., 0.016 + 0.058) of anion. Also, as the

styrene added in step 1 is completely polymerized prior to adding additional styrene and NBL in step 2, one might consider the overall process as generating a mixture of two block copolymers, as depicted below:



In the above figure, the numbers on the top of each diagram represent the weight percentages of styrene, and those on the bottom represent weight percentages of butadiene. The closed rectangular portions denote styrene polymer blocks, and the open portions, separated with diagonal lines, denote styrene-butadiene copolymer blocks.

The polymerization in step 1 proceeds to completion prior to adding more monomer. See '419 patent at col. 9, lines 34-35. Accordingly, this step leads to homopolystyrene because styrene is the only monomer present. Given the ratio of NBL to styrene in step 1 (i.e., about 1 to 1160), Applicants believe that the homopolystyrene blocks produced in this step would have a molecular weight of 120,000.

Thereafter, in step 2, to these blocks is added a second charge of NBL (0.058 phm) and additional styrene (12 phm) are added. Here, each of (a) the homopolystyrene from step 1 and (b) the newly added styrene monomer would undergo

polymerization: Some of the newly added styrene would add to the homopolystyrene from step 1 ("Polymer (1)") and some would polymerize independent of the homopolystyrene, forming new homopolystyrene ("Polymer (2)"). Based on the 0.016 phm anion equivalents arising from the living homopolystyrene in step 1 and the 0.058 phm anion equivalents newly added in step 2, one would expect about 22% ( $0.016/0.074$ ) of the newly added styrene to add on to Polymer (1) and about 78% ( $0.058/0.074$ ) to polymerize independent of Polymer (1), thus forming Polymer (2) with a molecular weight of 10,400.

No styrene is added in step 3. Accordingly, step 3 does not form any polystyrene blocks.

In step 4, butadiene (17.5 phm) and styrene (17.5 phm) are added concurrently, along with THF as a randomizer. A homopolystyrene polymer segment is not generated in this step. Rather, a random styrene-butadiene polymer is generated in step 4. As "blocks" must have a degree of polymerization of 30 or more, step 4 does not form any polystyrene blocks.<sup>1</sup>

In step 5, a final 10.5 phm styrene is added to the reaction. For the reasons described above for step 2, about 22% of this styrene would add a homopolystyrene block to Polymer (1) and, likewise, about 78% of the styrene would add a homopolystyrene block to Polymer (2). Each of these blocks would have a molecular

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<sup>1</sup> Applicants note that although this portion of the polymer does not constitute a "block" within the context of their invention, the presence of the block generated in step 1 makes the overall polymer a block copolymer regardless of this random copolymeric portion of the overall polymer.

weight of 9,000 because 10.5 phm of styrene in the presence of 0.074 phm of anion would, based on molar conversion, generate blocks with a degree of polymerization of about 86.4.

As described above, the following styrene monomers make up the styrene polymer segments in each of Polymers (1) and (2):

Step 1: styrene 30 phm (Mn: 120,000);

Step 2: styrene 2.6 phm ( $12 \times 0.016 / 0.07$ , Mn: 10,400);

Step 5: styrene 2.3 phm ( $10.5 \times 0.016 / 0.074$ , Mn: 9,000).

For additional clarity, each of Polymer (1), Polymer (2), and a mixture comprising both of Polymers (1) and (2) are described below in terms of their styrene content. Each of these polymers is also compared to Applicants' claims.

#### Polymer (1)

The sum of the styrene polymer segments (styrene blocks) in Polymer (1) is 34.9 phm. As described above, the 32.6 phm styrene polymer segment (30 phm from step 1 and 2.6 phm from step 2) arising from the combination of steps 1 and 2 has an Mn of 130,400 in total. The homopolystyrene polymer segment arising from polymerizing 2.3 phm of styrene in step 5 has a Mn of 9,000. In Polymer (1), only the 9000 molecular weight polymer (from step 5) meets the "molecular weight of 35,000 or less" limitation. The proportion by weight of a block having a molecular weight of 35,000 or less (i.e., the 9000 molecular weight block) is 6.5% by weight ( $= (2.3/34.9) \times 100$ ). Accordingly, the



claimed requirement that 40 to 80% by weight of the vinyl aromatic hydrocarbon polymer blocks have a molecular weight of 35,000 or less is not fulfilled for Polymer (1).

#### Polymer (2)

Only steps 2 and 5 contribute to the homopolystyrene block composition of Polymer (2). The sum of the homopolystyrene polymer segments (styrene blocks) in Polymer (2) is 17.6 phm: 9.4 phm from step 2 and 8.2 phm from step 5. As described above, Polymer (2)'s 9.4 phm styrene polymer block (arising from step 2) has a Mn of 10,400. Polymer (2)'s 8.2 phm styrene polymer block (arising from step 5) has a Mn of 9,000. Each of these two polymer segments (homopolystyrene polymer blocks) has a molecular weight of 35,000 or less. Accordingly, 100% of the homopolystyrene polymer blocks in Polymer (2) have a molecular weight of 35,000 or less. Accordingly, the claimed requirement that 40 to 80% by weight of the vinyl aromatic hydrocarbon polymer blocks have a molecular weight of 35,000 or less is not fulfilled for Polymer (2) because 100% is far outside of the 40-80% range claimed. In addition, the total styrene content in Polymer (2) is about 57% by weight, failing to satisfy the claimed requirement that the weight ratio of a vinyl aromatic hydrocarbon (i.e., styrene) and a conjugated diene is 60/40 to 90/10. For each of these independent reasons, Polymer (2) does not fall within the scope of Applicants' claims.

#### Mixture of Polymers (1) and (2)

The sum of the styrene polymer segments (styrene blocks) in a mixture of Polymers (1) and (2) is 52.5 phm. As discussed above, the number-average molecular weight of the homopolystyrene polymer segment arising from the combination of steps

1 and 2 (32.6 phm) is 130,400, the styrene polymer segment arising from step 2 (9.4 phm) is 10,400, and the total<sup>2</sup> homopolystyrene polymer segments arising from step 5 (10.5 phm) is 9,000. In the mixture, the proportion by weight of a block having a molecular weight of 35,000 or less among the vinyl aromatic hydrocarbon blocks is 38% by weight (= (19.9/52.5) x 100).

Regardless of whether either of the '419 patent's Polymers (1) or (2) are considered separately or together as a mixture,<sup>3</sup> they do not fall within the scope of Applicants' claims. Applicants respectfully request that the Examiner withdraw the rejection of claims 1-25 under 35 U.S.C. § 102(b) in view of the '419 patent because the '419 patent does not describe each and every aspect of Applicants' claims. Additionally, as the '419 patent provides no reason for purposefully modifying its teachings to arrive at the pending claims, Applicants respectfully request that the Examiner withdraw the rejection of claims 1-25 under 35 U.S.C. § 103.

#### **Rejection of claims 1-25 in view of U.S. Patent No. 6,107,411.**

The Examiner has rejected claims 1-25 under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 6,107,411 ("the '411 patent"). Office Action at 4-5. The Examiner contends that the '411 patent's example "P4" (col. 10, lines 5-25) discloses a block copolymer that is within the scope of the pending claims. Applicants respectfully assert that the '411 patent does not anticipate claims 1-25 for at least the reason that the '411

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<sup>2</sup> Step five generates a homopolystyrene polymer segment (a.k.a. a "homopolystyrene block" or simply a "polystyrene block") in each of Polymers (1) and (2).

<sup>3</sup> In either case (mixture or individual polymers), the product of the polymerization reaction should be considered a block copolymer because of the presence of one or more blocks within the overall polymer.

patent fails to describe a polymer that meets the weight ratio limitations of Applicants' claims. Additionally, Applicants respectfully assert that the '411 patent does not render their claims 1-25 obvious because the Examiner has provided no reason to modify the '411 patent to arrive at these claims.

In Example 4 of the '411 patent, the block copolymer P4 was obtained by adding monomers as summarized below (see '411 patent at col. 10, lines 4-22).

1. Styrene: 3.08 kg
2. Butadiene: 0.31 kg
3. Styrene: 7.92 kg, Butadiene: 1.23 kg
4. Butadiene: 0.31 kg
- 5: Styrene: 7.92 kg, Butadiene: 1.23 kg

The styrene added in steps 3 and 5 is added concurrently with butadiene, which would lead to styrene-butadiene copolymer as opposed to homopolystyrene blocks.<sup>4</sup> Accordingly, only step 1 in the P4 synthesis results in homopolystyrene blocks. As step 1 generates block polystyrene with a molecular weight of 25,000, each of the blocks of styrene in the P4 polymer is a "vinyl aromatic hydrocarbon polymer block having a molecular weight of 35,000 or less" as recited in claim 1. Because the P4 polymer has 100% of its polystyrene blocks having a molecular weight of 35,000 or less, it does not meet the claim requirement that 40 to 80% by weight of the vinyl aromatic hydrocarbon polymer blocks have a molecular weight of 35,000 or less. Accordingly, the '411 patent

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<sup>4</sup> Although the segment generated in each of steps 3 and 5 is not a block, the overall polymer may still be considered a block copolymer because of the block generated in step 1; *see also supra* at notes 1 and 3.

does not anticipate Applicants' claims. Additionally, the '411 patent does not render Applicants' claims obvious because the Examiner has not provided a reason to modify the '411 patent in a way that reduces the percentage of vinyl aromatic hydrocarbon blocks that have a molecular weight of 35,000 or less from 100% to between 40-80%. In view of the above comments, Applicants respectfully request that the Examiner withdraw the rejection of claims 1-25 under either of 35 U.S.C. §§ 102(b) or 103.

**Rejection of claims 1-12 and 14-25 in view of U.S. Patent No. 6,162,867.**

The Examiner has rejected claims 1-12 and 14-25 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 6,162,867 ("the '867 Patent"). Office Action at 4-5. The Examiner notes that the '867 patent discloses, at column 13, lines 27 *et seq.*, "a block copolymer in which styrene is polymerized using an alkyl lithium initiator in the presence of a randomizer following which mixed multiple charges of styrene/diene are polymerized in which high ratios of styrene/diene are used and in which the calculated molecular weight of the homopolystyrene block resulting from polymerization of the pure styrene charge is less than 35,000." *Id.* at 5. Applicants respectfully submit that the '867 patent neither anticipates nor renders obvious the pending claims for the reasons discussed below.

The Examiner refers to the synthesis of "Component C" in the '867 patent, which is described at col. 13, lines 27 *et seq.* and in Table 1. This synthesis consists of five individual polymerization steps. Only steps 1 and 5 generate styrene polymer blocks because steps 2 to 4 include adding both styrene and butadiene in the presence of a

randomizer, which results in a random copolymer.<sup>5</sup> The molecular weight of the styrene polymer blocks arising from the styrene monomers added in steps 1 and 5 is about 14,000 (= 131,000 x (1048 g/10,043 g)). Each of these blocks has a "molecular weight of 35,000 or less". Since only steps 1 and 5 generate styrene polymer blocks and each of these steps generates a block having molecular weight of 35,000 or less, 100% (rather than 40-80%) of the vinyl aromatic hydrocarbon polymer blocks have a molecular weight of 35,000 or less. Accordingly, the polymer described in the '867 patent fails to meet the limitations of Applicants' claims 1-12 and 14-25, thereby failing to anticipate these claims. Additionally, the '867 patent does not render Applicants' claims obvious because the Examiner has not provided a reason to modify the '867 patent in a way that reduces the percentage of vinyl aromatic hydrocarbon blocks that have a molecular weight of 35,000 or less from 100% to between 40-80%. In view of the above comments, Applicants respectfully request that the Examiner withdraw the rejection of claims 1-12 and 14-25 under either of 35 U.S.C. §§ 102(b) or 103.

**Rejection of claims 1-25 in view of U.S. Patent No. 6,841,261.**

The Examiner has rejected claims 7-25 under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over WO 02/38642. Office Action at 5-6. The Examiner notes that English language document U.S. Patent Application Publication No. 2004/10102576 is equivalent to the WO 02/38642 and bases the rejection on this publication. Applicants believe that U.S. Patent No. 6,841,261 ("the '261 patent") is the issued patent corresponding to U.S. Patent Application Publication No. 2004/10102576 and base our remarks on the '261 patent.

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<sup>5</sup> See *supra* at note 4.

The Examiner notes that Example 23 of the '261 patent discloses "a block copolymer in which styrene is polymerized by using an alkyl lithium initiator in the presence of a randomizer following which mixed multiple charges of styrene/diene are polymerized in which high ratios of styrene/diene are used and in which the calculated molecular weight of the homopolystyrene block resulting from polymerization of the pure styrene charge is less than 35,000." Office Action at 6; See the '261 patent at col. 27, lines 34-58. As discussed below, the '261 patent does not describe or render obvious Applicants' claims.

First, in Example 23 of the '261 patent, the styrene content in the overall polymer is 91.0% by weight, which fails to satisfy the claimed requirement that the weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene is 60/40 to 90/10. See '261 patent at col. 27, lines 34-58. Second, the proportion of styrene polymer blocks having a molecular weight of 35,000 or less is 100%, which fails to satisfy the 40-80% claim limitation.

The styrene polymer blocks formed by each of the initial and final addition of 10.5 kg of styrene would have a weight-average molecular weight of about 8,000 ( $= 159,000 \times (10.5 \text{ kg}/210 \text{ kg})$ ). In the intermediate steps, a monomer mixture of 34 kg of styrene and 3.8 kg of butadiene was added concurrently and polymerized to greater than 99% completion. Thereafter this process was repeated four times, for a total of five iterations. Applicants believe that this concurrent addition of styrene and butadiene would probably result in a random copolymer. As a result, only the first and final steps in Example 23 form polystyrene "blocks" within the context of Applicants' invention. Each of the initial and final styrene charges generates a polystyrene block with a

molecular weight of 8000. Accordingly, all of the styrene polymer blocks in Example 23 correspond to the "vinyl aromatic hydrocarbon polymer block having a molecular weight of 35,000 or less" because all of the steps that generate polystyrene blocks generate such blocks with a molecular weight of 35,000 or less. Thus, the proportion of such polymer blocks is 100%, which fails to satisfy the claimed requirement (i.e., 40 to 80%). Additionally, as discussed above, the styrene content in the overall polymer is 91.0% by weight, which fails to satisfy the claimed requirement that the weight ratio of a vinyl aromatic hydrocarbon and a conjugated diene is 60/40 to 90/10. Accordingly, the '261 patent does not anticipate Applicants' claims because it fails to describe at least two of Applicants' claim limitations. Additionally, the '261 patent does not render Applicants' claims obvious because the Examiner has not provided a reason to modify the '261 patent in a way that reduces the percentage of vinyl aromatic hydrocarbon blocks that have a molecular weight of 35,000 or less from 100% to between 40-80%. In view of the above comments, Applicants respectfully request that the Examiner withdraw the rejection of claims 1-25, over the '261 patent, under either of 35 U.S.C. §§ 102(a) or 103.

### **Conclusions**

In view of the above remarks, Applicants respectfully request that the Examiner withdraw the rejection of claims 1-25 under 35 U.S.C. §§ 112 and 102 or 103. Applicants have (1) pointed to specific portions of the Specification which define the block copolymer aspect of their claims, (2) illustrated how this definition may be applied to at least five examples cited by the Examiner, and (3) articulated how each of the

references cited by the Examiner neither anticipates nor renders Applicants claims obvious under any reasonable interpretation.

If there are any fees due in connection with the filing of this response, please charge the fees to Deposit Account No. 06-0916. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such an extension is requested and the fee should also be charged to our deposit account.

Respectfully submitted,

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Dated: October 28, 2008

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